DOCUMENT RESUME

ED 060 702 FL 002 949

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TITLE The Relationship Between Age and Accuracy of Foreign Language Pronunciation.
PUB DATE 4 Apr 72
NOTE 17p.; Speech presented at the American Educational Research Association Annual Meeting, April 4, 1972, Chicago, Illinois

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS Adults; *Age Differences; Children; Environmental Influences; German; *Language Ability; Language Development; Language Instruction; Learning Theories; Phonemes; *Phonology; *Pronunciation; *Second Language Learning; Tables (Data)

ABSTRACT

The purpose of this study is to test the commonly held assumption that younger children are superior to those who are older in learning to speak a second language with a good accent. Students from the elementary, junior high, and college levels are tested after receiving identical instruction in German phonemes. Post-test results indicate that both the junior high and college groups are superior to the elementary age group. There is good evidence that the age-language acquisition relationships favoring younger students hold for first languages only. The common observation that children acquire better language pronunciation than adults may have an environmental-socioeconomic explanation and depend on the differences in the way each group is able to acquire the second language. It is more probable that children would have a closer approximation to native-like pronunciation because they are surrounded by good models more of the time than their adult counterparts. (Author/VM)

ED 060702

The Relationship Between Age and Accuracy of Foreign Language Pronunciation

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Abstract

The assumption that younger children can master the phonological system of a second language more easily than those who are older was tested under laboratory conditions. This assumption is based on observations of immigrant children in natural settings and findings related to the ability of various age groups to recover full use of speech function following trauma to the dominant cerebral hemisphere.

In the study, each of three groups of 20 elementary, 20 junior high and 20 college students received 10 sessions, each 15-25 minutes in length of pre-taped German phoneme pronunciation instruction. A total of 33 phonemes were taught in two weeks using various mimicry drills. The students were pre-tested and post-tested and given the Raven Progressive Matrices Test. Analysis of variance and covariance on the pretest indicated no difference in pronunciation. Contrary to common belief, on the posttest the junior high and college groups were significantly ($p<.01$) better at pronunciation than the elementary group.

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FL 002 949

The Relationship Between Age and

Accuracy of Foreign Language Pronunciation

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It has been assumed for many years that foreign language training in the elementary school was advantageous to comprehensive foreign language skill development. Specifically, many people, such as Carroll (1963), believe that younger children can acquire a more native-like accent in a second language than older students. Others have carried this assumption further to say that a child will be superior in other foreign language skills such as syntax and vocabulary acquisition. In addition, the child's enthusiasm and open-mindedness to the study of foreign language and culture and the need for a long study sequence have led many to press for foreign language education in the elementary school (FLES). However, there is a lack of firm evidence to back these assumptions.

The literature regarding age and foreign language study, focusing on foreign language pronunciation, can be divided into three classifications: theory, common (anecdotal) observations, and experimental research.

Theory. The theoretical support for notions regarding the relationship between age and foreign language acquisition comes from inferences drawn from psychological and physiological investigations. One example is the brain plasticity theory (Asher and Garcia, 1969). According to this theory, the younger child has a "cerebral receptivity" to language acquisition--in other words, due to differences in brain functioning younger children find it easier to acquire language. This receptivity may be a function of the organizational plasticity of the brain or lack of cortical specialization.

As the child matures, the organization of the cerebral cortex becomes more specialized until speech is completely lateralized in the left cerebral hemisphere. As the organization of the brain becomes more specialized, the individual's capacity to learn a language tends to decrease.

Clinical evidence for such a theory comes from physiological studies. Penfield and Roberts (1959) found that children--but not adults--can regain speech functions following injury to the speech area in the left or dominant cerebral hemisphere. For those children, who learned to speak again, the speech area shifted from the left to the right cerebral hemisphere. This shift was demonstrated by injecting sodium amytal into the carotid artery which produced interference with the function of the right cerebral hemisphere, resulting in hemiplagia and a temporary loss of speech (aphasia) until the drug wore off. This shift of the speech area of the cerebral cortex which occurs in children but not adults, strongly suggests cerebral plasticity in children but not adults. From this and other evidence, Penfield concluded that near ten years of age was the critical period in the change of plasticity. Therefore, Penfield suggested that foreign language instruction begin before age ten to take advantage of this critical period in developing good foreign language skills in the child.

Lenneberg (1967), summarizing case histories of brain damage with acquired aphasia, also infers a physiological age limitation for normal first language acquisition, which corresponds with cerebral lateralization of the speech function and change in organizational plasticity. Two lines of evidence support the physiological age limitation viewpoint. Evidence for the first is shown by the difference in probability of recovery from acquired aphasia between children and adults, which is a function of the

age at which the brain damage occurred. Below the age of ten, children can relearn language without permanent aphasic symptoms. However, between ten and puberty traces of aphasia remain permanently in the patient's speech. The amount of permanent aphasic symptoms increases during the middle teens. In adulthood (after the age of eighteen), those with well-established aphasia fail to overcome their language difficulties despite training. Therefore, Lenneberg infers that language learning can take place at least in the right hemisphere, only between the ages of two and about thirteen. Thus we can see that as far as ease of primary language learning and relearning following injury are concerned, Lenneberg and Penfield are in agreement regarding physiological age limitations.

Although Lenneberg (1967, p. 176), believes there is a fundamental difference between first and second language acquisition, he believes that age seems to influence most the retention of foreign accent and the ability to learn a foreign language just from exposure in the natural setting without formal training. It must be emphasized that the conclusion that children have a foreign language capacity which adults do not, as inferred above, is not based on direct experimental data.

Common Observation. The ability of children to achieve a more native-like pronunciation of a foreign language than older students is the most common reason given for beginning foreign languages in the elementary school. This is based on the frequent observation that immigrant children acquire native-like speech much more rapidly than their parents.

But there are many factors which obscure the foreign language learning process in the natural setting and thereby limit the relevance of observations such as the above until they are verified by empirical research.

Experimental Research. Asher and Garcia (1969) proposed that the child's observed language facility in the natural setting may be due to his learning the foreign language in a physically active, play situation, whereas, adults do so in a non-physically active, non-play situation. As a test of this concept, Asher and Price (1967) investigated the relationship between age and Russian listening comprehension. When both college age adults and children (ages 8, 10, and 14) were taught Russian comprehension in situations in which the Russian utterances were synchronized with physical movement, the adults did much better than the children, and in turn the older children surpassed the younger children in Russian listening comprehension. This experiment, however, does not address itself specifically to problems of age and foreign language pronunciation.

In the area of age and foreign language pronunciation, the existing experimental research provides conflicting evidence supporting the superiority of both children and adults. There is informal evidence from a number of FLES program evaluations which supports the superiority of younger children. One such program was conducted by Dunkel and Pillet (1957). Following two years of French instruction, given for fifteen to twenty minutes each day, beginning in grades three and four, the third and fourth graders were judged by the staff and by outside graduate students to have better pronunciation and intonation than the older students. According to the opinion of the experimenters "the pronunciation of the children, as a group, was superior to that generally achieved by adults in classes during an equal or even

much longer span of time." Max Kirch (1961) came to a similar conclusion after teaching German to normal first, third and sixth graders, that the younger the student the better the pronunciation. In comparison to his university students, he felt all three groups had excellent pronunciation. The findings of both of these studies were based on uncontrolled classroom situations, comparisons of dissimilar programs and the personal judgement of the teachers or experimenters and therefore need to be viewed with caution.

Opposite results were reported by Grinder, Otomo and Toyota (1961) who found that pronunciation accuracy of Japanese increased with the child's age in second, third and fourth grade. Bland and Keislar (1966) found in a French audio-lingual pilot program with four kindergarten students and six fifth-graders "no evidence that younger children had better pronunciation." The sample here was to small to be broadly generalized, but it does provide suggestive data, however.

Lambert and MacNamara (1969), in evaluating a year-long experimental program to develop second language (French) skill by using it as the sole means of instruction with native-English speaking first-graders, found that the children's ability to produce French phonemes was average with reference to native speakers as judged by a French linguist. But they were still poorer than the native French speaking controls, who were taught the same material in a comparable French environment. While the observation on pronunciation is experimentally sound, it does not give any comparison to older children in a comparable program.

Asher and Garcia (1969) attempted to determine the factors related to the achievement of native pronunciation of English as a second language.

Cuban immigrants, ranging in age from 7-19, who had learned English in a natural setting while living and going to school in the United States were judged by American high school students. The evaluation indicated that no Cuban child achieved a native pronunciation of English. But a near-native pronunciation was most apt to occur if the child was 6 or younger when coming to the U.S. and had lived in this country between 5-8 years.

Further information applicable to foreign language pronunciation learning is found in controlled experimental studies of dialect training, (the teaching of standard white speech), which resembles second language learning. Torrey (1971) found, after an hour of individual training on a single grammatical point with both black and white Connecticut second graders, a change in written comprehension but no change in spontaneous oral production. Rystrom (1970) found no difference in the ability to pronounce standard white phonemes between Georgia Negro first-graders with dialect training and those with none. Kennedy and Rentel (1971) also found no phonological differences after six weeks of dialect training of rural Appalachian first graders. Kennedy and Rentel concluded that grammar comprehension is much easier to modify than phonology in the "classroom learning situation where systematic attention is not directed toward linguistic features." This emphasizes the difficulty of teaching native foreign language pronunciation in the classroom situation during a limited period of time, and suggests that to attain the goal of good phonology, a longer sequence of instruction is required.

None of the previous experiments or FLES program evaluations have shown whether elementary children can achieve more native-like pronunciation of the foreign language than older teenage or college students under properly

controlled conditions in a setting which is applicable to the normal foreign language classroom. The purpose of this study was to test the commonly held assumption that younger children are superior to those who are older in learning to speak a second language with a good accent. In the test of the assumption, the critical age periods for brain lateralization were incorporated into the design.

Method

Subjects

Each of three groups of 20 elementary (ages 9.5-10.5), 20 junior high (ages 14-15) and 20 college students (ages 18-26) were randomly selected. All subjects had no previous formal foreign language instruction and came from homes in which no foreign language was used. A fairly even division between girls and boys existed in the two younger groups but was not possible in the oldest group (elementary: 11 girls, 9 boys; junior high: 9 girls, 11 boys; college: 2 girls, 18 boys).

Design

A 2(sex) X 3(age groups) factorial design was used.

Instructional Materials and Instruments

Instructional materials consisted of 10 pre-recorded tapes, each 15-25 minutes in length containing German phoneme drills which were based on The Sounds of English and German (Moulton). The thirty-three phonemes selected for the drills were those which differ from English phonemes and which therefore present the most difficulty for English speakers learning German. A native German speaker read the German part of the script and the English-speaking experimenter the English. The experienced foreign language teachers who developed the materials and procedures judged them to be suitable for each of the groups in the study.

The format for the drills was: German utterance, pause for unison repetition by the experimental group, repetition of the German utterance for reinforcement, pause for unison repetition by the group. For key drills this format was enlarged upon by breaking the large group into four smaller groups and having each of the smaller groups repeat the same utterance as the entire group had just done. After the fourth small group had responded, the entire group repeated the utterance as at first.

The drills used successive approximation, syllable variation, contrastive words and short sentences. Previously taught phonemes were reviewed regularly.

A standard classroom tape recorder was used for instruction.

Procedure

Each group participated in thirteen sessions over a period of three weeks. Ten sessions consisted of pre-taped German phoneme instruction, each group being given the same ten tapes. Three additional sessions for each student were devoted to administering the Standard Progressive Matrices (Raven) Test and taping individual pre- and post-tests.

The students were taught to pronounce the words by modeling their pronunciation after the German voice on the tape as accurately as they could. The experimenter led the subjects during the sessions by quietly uttering or mouthing the words on tape and by using hand signals and facial gestures to reinforce procedures and directions on the tape.

Testing and Evaluation

The students were given the Standard Progressive Matrices (Raven, 1960) Test to measure intellectual ability. Derived z-scores from the subjects' raw scores on the Standard Progressive Matrices Test were used as a co-variate in the data analyses.

Equivalent taped pre- and post-tests, each containing 25 target phonemes in short words and sentences to be repeated onto a blank tape, were given to each subject individually using two tape recorders, head sets and patch cord links.

In order to prevent bias in scoring phoneme production, before the tapes were evaluated, the experimenter randomly spliced together the subjects' responses for all three age groups. This was done for a pretest and posttest tape. These tapes were evaluated by a native German speaking graduate student and an American graduate student majoring in German. The judges did not know the nature of the experiment and were told only that they were to evaluate different people in pronouncing German phonemes. They made separate evaluations and scored each phonemic test item for each subject on a scale of 0-4. Four was native-like pronunciation, three good, two average, one poor but an attempt and 0 was no attempt. Only the target phoneme in each test item was evaluated.

To check on intrajudge reliability, the judges unknowingly scored eighteen subjects' responses twice on both the pretest and posttest. Inter-judge reliability was checked by comparing the evaluations of judge 1 against judge 2.

Results

Table One presents the data on intrajudge and interjudge reliability.

Table Two shows the German phoneme pronunciation scores for each of the groups. The mean score represents tests one through 25 where a maximum score of 100 was possible on either the pretest or posttest.

The covariates used in data analysis are derived Raven 2-scores to which 1 was added to get rid of negative numbers. Therefore, a score of 1 indicates a mean Raven's score for the group using the Raven norms.

The pretest results, using analysis of variance and analysis of covariance showed no significant difference in pronunciation either for sex or for age groups or their interaction.

On the posttest, the analysis of variance indicated the following: no significant sex effect ($F=<1$, 1/54df, ns) and no significant interaction between age groups and sex ($F=<1$, 2/54df, ns). However, there was a significant age group effect on accuracy of pronunciation ($F=5.29$, 2/54df, $p<.008$).

The analysis of covariance produced highly similar results: no significant sex effect ($F<1$, 1/53df, ns) and no significant interaction ($F<1$, 2/53df, ns). Again, there was a significant age group effect on pronunciation accuracy ($F=5.17$, 2/53df, $p<.009$).

Newman-Keuls tests were computed to determine among which age groups were there significant differences in accuracy of pronunciation on the posttests. Contrary to common assumptions, both the junior high and college groups were superior to the elementary age group ($p<.01$). There was no significant difference between the two older groups in pronunciation accuracy.

Discussion

The general assumption is that younger children learn to produce foreign words with a more native-like accent than older people. Not only is this assumption not supported by the test results but the trend is in a reverse direction favoring older students.

There is good evidence, however, that the age-language acquisition relationships favoring younger students hold for first languages only. Therefore, we must distinguish between first and second language learning as Lenneberg did, in stating that the biological conditions which are important in primary language learning are not so important in second language learning.

Our evidence suggests that adults are superior to children in foreign language pronunciation. Therefore, the question needs to be answered as to why there is a difference between common observations that children are superior and the findings of this study. One possible answer lies in the fact in the present study important factors in foreign language pronunciation learning, such as amount of time spent on training and quality of the language model were controlled for all groups.

The common observation that children acquire better second language pronunciation than adults may have an environmental-sociological explanation. Studies have shown that people model their foreign language pronunciation after their peers. Immigrant adults tend to associate more with peers who speak their native language than children. For instance, husbands would continue to use the native language when speaking with their wives or with other members of their families. Often times immigrant families have tended to settle in areas where there are other families of similar origin. These adult peers reinforce poor second language pronunciation habits. Similarly, the contacts which these adults would have with good pronunciation models are limited. Children, on the other hand, would be more apt to come in contact with people such as teachers and native-speaking classmates, who have a good accent to model. Thus it is more probable that children would have a closer approximation to native-like pronunciation because they are surrounded by

good models more of the time than their adult counterparts.

The dialect training studies show the difficulty in modifying phonological behavior in a relatively short period of time. If further experiments confirm the results of this study, the old reason for starting foreign languages in the elementary school should be abandoned, namely, that children have a natural advantage in learning to produce the sound system of a new language. This statement does not imply that foreign language training should not start in the elementary school, since a long period of time is required for mastery of a foreign language.

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Table One

Intrajudge Reliability

	Judge 1			Judge 2		
Average	0	-1	0+-1	0	-1	0+-1
Pretest	58%	32%	90%	49%	42%	91%
Posttest	47%	46%	93%	48%	44%	92%
Total	52%	39%	91%	48%	43%	91%

Interjudge Reliability

	Pretest			Posttest		
Average	0	-1	0+-1	0	-1	0+-1
Elementary	84%	16%	100%	83%	14%	97%
Junior High	80%	18%	98%	82%	17%	99%
College	71%	24%	95%	88%	8%	97%
Total	78%	19%	97%	84%	13%	97%

0 indicates perfect correspondence.

-1 indicates a difference of 1 out of a range from 0-4.

0+-1 is the sum of the two.

Table Two

German Pronunciation Scores

for Boys and Girls for Elementary, Junior High and College Groups

	Pretest*		Posttest*		Ravens Score**	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Elem.						
Boys n=9	52.39	8.57	60.44	11.05	1.30	0.87
Girls n=11	56.68	11.61	67.55	11.04	2.11	0.36
Jr. Hi.						
Boys n=11	57.50	12.71	73.91	9.27	1.69	0.87
Girls n=9	56.00	7.30	71.78	7.60	1.70	0.54
College						
Boys n=18	59.97	11.54	74.19	9.56	2.01	0.37
Girls n=2	53.25	0.35	78.25	4.60	1.60	0.28

* Means and standard deviations for pretest and posttest scores are based on the sum of the scores for variables (test items) 1-25.

** Ravens Score is based on z-scores + 1.